

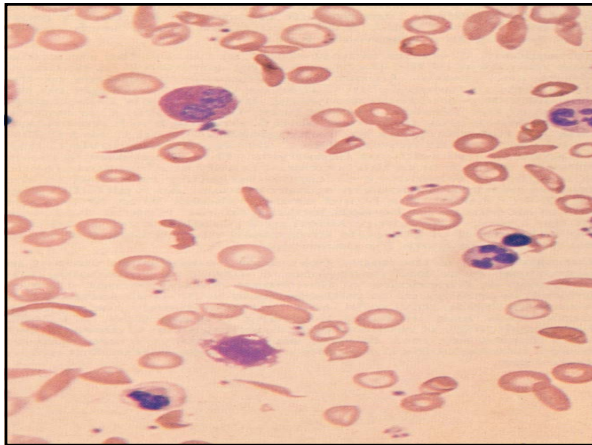
Sickle Avascular Necrosis

Ify Osunkwo, MD, MPH
Assistant Professor
Pediatric Hematology/Oncology/BMT
Emory University



Objectives

- Definition, epidemiology
- Pathophysiology
- Clinical Presentation
 - diagnostic tools
 - classification
- Public Health burden
- Treatment options
- Research opportunities



Avascular
Necrosis of
Femoral Heads

Bilateral Femoral
Arthroplasty



What do they have in
common?



Avascular Necrosis Definition

- * Osteonecrosis, Aseptic necrosis, ischemic bone necrosis,
- * Complete disruption of vascular supply to the articular surfaces and ends of long bones,
- * Cellular death (necrosis) of bone due to interruption of the blood supply.
- * Osteonecrosis is bone death caused by poor blood supply to the area.

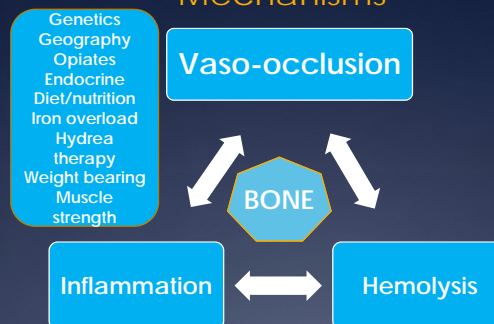
Epidemiology

- * Femoral head > shoulder > knees
- * Can occur in any bone with blood supply
- * Extremely common, starts early
 - * 26% by age 10y
 - * 48% by 27y
 - * >50% prevalence by age 35y
- * 4y progression rate of 67%
- * Bilateral in 41-90%
- * Progression to collapse in 3-5y

Pathophysiology

- * Obstructed perfusion
- * Ischemia -> Necrosis
- * Hemolysis -> NO deficit-> Oxidant stress
- * Inflammation – Edema -> Increased intra-osseous pressure
- * Failure of weight bearing
- * Collapse of joint/bone

Mechanisms



Risk Factors for AVN

- * Male
- * High Hgb
- * Low Hgb F
- * Vitamin D deficiency
- * Frequent VOC
- * Alpha thal trait

Case I

- * 16y Hgb SC,
- * Frequent VOC, psychiatric symptoms
- * Chronic knee pain
- * Severe Headaches
- * Unable to stand up straight
- * Neurology referral
- * Hip AVN

Case I



Case II

- * 14y Hgb SS, Abnormal TCD, delayed puberty
- * Chronic transfusion x 4 years
- * Weaned to Hydrea
- * Limping, no admits for pain x 4years
- * Home Pain diary showed daily pain after school
- * PE – unequal limb length

Case II



Case III

- * 17y Hgb SS, recurrent ACS
- * Early Retinopathy since 7y
- * Frequent VOC, gall stones
- * Short Stature and delayed growth
- * Vitamin D deficiency
- * On Hydrea with good response
- * Playing on inflatable gym → hip dislocation

Case III



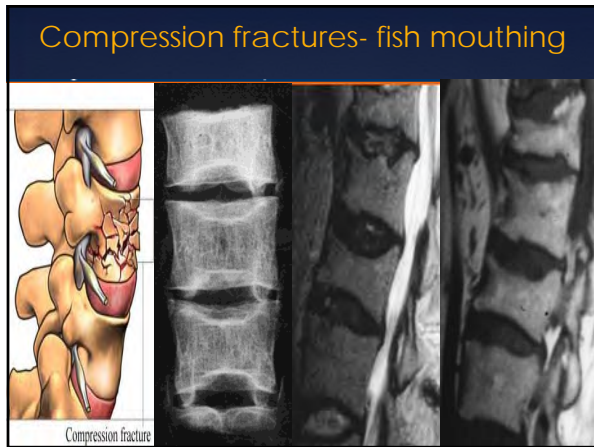
Clinical presentation

- * Variable
- * X-ray and symptoms don't always match up
- * Pain in back, hip, knee, ankle or shoulder
- * Reduced Range of Motion at joint
- * Limp, "popping sound"
- * Limb length discrepancy

FICAT STAGING

	Pain	X-ray image	Magnetic resonance image
Stage I	+	Normal	+
Stage II	+	Changes on bone trabeculate with sclerosis or osteolysis areas	+
Stage III	+	Osteochondral fracture with sequestrum and flattening of the head	+
Stage IV	+	Advanced lesions	+

Table 1 – Classification by Ficat et Ariet⁽¹⁾ and Steingberg⁽²⁾



- ### Treatment
- * Physical Therapy
 - * Strengthen limb girdle, joint
 - * Flexibility
 - * Re-perfusion and healing
 - * Non weight bearing
 - * If advanced/collapse
 - * Core decompression +/- osteotomy
 - * Inject stem cells
 - * Hip replacement
 - * Longevity limited 10-15y, failure
 - * Location (poor in shoulder)
 - * Muscle imbalance, joint instability, length discrepancy,



Differences

- | | |
|-----------------------|--|
| * Older (>50y) | * Young (<20y) |
| * Caucasian | * African descent |
| * Female | * Male |
| * No hemoglobinopathy | * Sickle Cell Disease |
| * Insurance | * Self pay |
| * Drinks milk | * Lactose Intolerance |
| * Prevention possible | * No data on effective prevention – YET! |

What do they have in common?



Similarities

- | | |
|----------------------------|----------------------------|
| * Osteoporosis | * Osteoporosis |
| * Hip replacement | * Hip replacement |
| * Chronic back/limb pain | * Chronic back/limb pain |
| * Wheelchair confined | * Wheelchair confined |
| * Poly pharmacy pain meds | * Poly pharmacy pain meds |
| * High risk of fall, death | * High risk of fall, death |

Take Home

- * AVN is VERY common in SCD
- * Occurs as early as age 7y
- * May be asymptomatic in early stages
- * X-ray may miss early stage
- * All SCD genotype are at risk
- * No proven prevention

Research directions

- * Epidemiology in era of Hydroxyurea
- * GWAS to identify gene polymorphisms e.g. BMP
- * Mouse models of bone disease
- * Perfusion imaging of target bone
- * Platelet pore plasma injected into core
- * others

Resources

- * www.scinfo.org
- * www.cdc.gov/ncbddd/sicklecell/
- * www.choa.org/sicklecell